

S P E C I F I C A T I O N

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This invention relates to an apparatus and method for coding and reading objects such as cards, sheets, envelopes, boxes and otherwise shaped articles of manufacture for the purpose of identifying, keeping track of, routing and conveying same to selected destinations. Radiation beam ^{and control} generating means ^{is} employed for recording codes on objects and, in certain instances, for reading such codes.

A number of methods are known for the scanning and sorting of cards and pieces of mail for filing or distributing same and retrieving a selected unit. It is known, for example, to punch holes in a card and to drive said card through a scanning device including electrical contact or optical scanning means which is operative to generate one or more codes indicative of the identification of the card. Such punchings or cutouts are generally provided longitudinally along the face of the card and suffer a number of shortcomings. It is obvious that cutouts cannot be utilized for the coding or sorting of envelopes such as mail. Such coding and sorting is generally effected by printing alphanumeric characters or a train of numbers which are electro-optically scanned by a device reading the face of the envelope. In the latter arrangement, various shortcomings are also experienced, one of which includes the necessity of separating stacked envelopes and properly disposing same with respect to the reading device which generally comprises one or more banks of photomultiplier tubes or reading heads. Unless all characters are predeterminedly positioned on the face of the envelope, a condition which is generally very difficult to attain in an automatic sorting system applied to mail and the like, the reading device requires a relatively complex means for aligning its optical system on the envelope

so as to permit reading the proper line of characters while ignoring other characters associated with other information on the face of the envelope. Another shortcoming includes, in addition to separating envelopes from a stack thereof, various problems involved in reading envelopes of different sizes, positioning envelopes so that the information bearing face is in the direction of the electro-optical scanning means, and assuring that the envelope is ^{at} in the proper attitude ^{at the location} where type-written characters are to be read.

Furthermore, conventional electro-optical character reading equipment is relatively complex and quite expensive to manufacture and use as it requires very sophisticated electrical logic circuitry.

It is, accordingly, a primary object of this invention to provide a new and improved record scanning system of simple structure and operation.

Another object is to provide a coding, sorting and scanning system applicable for the automatic distribution of record cards, pieces of mail and the like.

Another object is to provide an improved system for scanning and coding oblong, flat objects such as envelopes and cards which system ^{includes means for} operates by coding and scanning an area ^{along} the edge or ~~edge~~ border of each member which ^{is} ~~may be~~ easily positioned to effect the scanning of said area without the need for relatively complex conveying and scanning apparatus.

Another object is to provide a new and improved apparatus for scanning coded cards and envelopes which is relatively inexpensive and simple to operate.

Another object is to provide a card and envelope scanning apparatus which does not require complex means for locating identifying codes and may be operated without the use of complex logic circuitry for determining said codes.

Another object is to provide an improved system for coding and sorting mail which is relatively inexpensive and uncomplicated.

Another object is to provide an improved method and apparatus for coding pieces of mail, such as envelopes and cards, by employing the force of gravity to align the lower edge of said mail with a ^{coding} ~~coating~~ means and also utilizing gravity for alignment during reading, thereby eliminating a substantial amount of equipment ordinarily needed for providing coded characters on the face of an envelope and thereafter aligning said envelope characters with a reading device.

Another object is to provide a new and improved apparatus and method for coding and routing packages, pallets and other objects having an alignable straight edge portion.

Another object is to provide an improved routing apparatus for articles such as mailpieces including ^{means for applying} ~~coding or recording~~ means for coding in the form of a coating, film or tape such as ^{to such articles} magnetic recording material.

Another object is to provide improved rotary means for applying variable series codes to stationary articles or articles moving therepast.

Another object is to provide a method and apparatus for coding articles in a manner to permit simple reading of the applied codes by ^{the} spray application of coding or codable material on predetermined areas of said articles.

Another object is to provide a method and apparatus for coding and identifying articles by recording codes on said articles with a modulated intense radiation beam such as a light beam generated by a laser operative to discolor or burn codes in the surface strata of the articles.

With the above and such other objects may hereinafter more fully appear, the invention consists of the novel constructions, combinations and arrangements of parts as will be more fully described and illustrated in the accompanying drawings, but it is to be understood that changes, variations and modifications may be resorted to which fall within the scope of the invention as claimed.

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P IN THE DRAWINGS

Fig. 1 is a schematic diagram illustrating an article coding, reading and routing system which is particularly applicable to the routing of mail pieces and information bearing cards;

Fig. 2 is an end view of one type of conveyor for oblong flat articles of the type conveyed in Fig. 1;

Fig. 3 is a side view with parts broken away for clarity of a modified form of the feed and conveying means of Fig. 1;

Fig. 4 is a side view of one form of piece conveyed by the apparatus of Figs. 1-3;

Fig. 5 is a side view of another form of piece conveyed by the apparatus of Figs. 1-3; and

Fig. 6 is a fragmentary view of another form of piece which may be coded and conveyed by apparatus of the type described.

Fig. 7 is a side view with parts broken away for clarity of a portion of a wheel-device operative for recording series codes along a band area of a card, envelope, box, tape or other article.

Fig. 8 shows one form of circuitry for controlling the recording of a code on a moving object.

Fig. 9 shows an apparatus for indentifying and coding articles moving on a conveyor. - 5 -

DE In Fig. 1 is shown part of a system for automatically coding and routing articles such as envelope and card mail pieces. However, the system illustrated in Fig. 1 is also applicable to the coding and routing of packages by utilizing most of the scanning, coding and conveying techniques provided therein.

The coding and sorting or routing system 10 includes a first means 11 such as a feeding bin or other suitable storage means for a plurality of mail pieces or cards which are individually designated by the alphabetical character E. The pieces E to be coded and routed may be horizontally or vertically stacked within the bin or feed magazine 11 in accordance with known designs, one such magazine being illustrated in U. S. Patent ^{No.} 2,891,467 ^{contains} ~~as containing~~ means for feeding individual mail pieces to an outflow conveyor. In Fig. 1, the mail pieces E are fed in a horizontal stack and the endmost piece is disposed against a power-driven conveyor belt 12 which, cooperates with a feed mechanism 12 which is ^{driven} ~~powered~~ together with the belt 13, by a controlled electric motor 14 which operates ~~intermittently~~ ^{intermittently} to feed individual mail pieces or cards onto a conveyor 15 leading to a conveyor 19 at the coding station 20. Conveyor 15 ~~is~~ ^{is} intermittently driven by a controlled electric motor 16, which like motor 14, is preferably a gear motor and has respective start and stop controls designated F and S which may comprise the inputs to a pulse operated bi-stable switch feeding electrical energy to the input of said motor. Motor 14 may be similarly operated, although in Fig. 1, ^{it} is illustrated as having a single control line input thereto for pulsing the motor control ^{and} ~~comprising~~ part of the unit 14, ^{and such} ~~which~~ control is operative when so energized to cause the motor and the mechanism driven thereby to operate in a single cycle for releasing just one card or mail piece E from bin 11 to the

conveyor 15 as provided, for example, in the Recordak 300 Stack-
Reader for feeding cards to a reader. B

The conveyor 15 is operative, as illustrated in greater detail in Fig. 2, to convey the lower edge 73 of a card or envelope along a predetermined path or line so that said lower edge will be properly disposed for applying a code recording or marking therealong ^{Such as} on the border area adjacent said ^{lower} edge as will be hereafter described. Thus, regardless of the height and length of the envelope, all envelopes will contain a code sorting or destination recording along their lower edges or borders which may be easily read for sorting purposes by pre-determinately positioning and conveying each piece with the lower edge thereof travelling along the same path as the lower edges of all ^{Such} other pieces.

A photoelectric detector 17 is disposed immediately adjacent conveyor 15 and is operative to detect the leading edge 731 of a piece E travelling along conveyor 15. The photoelectric controller 18 for the cell or scanning system 17 is operative to generate an output pulse upon detecting ^{Such} said leading edge, which pulse is ^{applied} fed to the stop control S of motor 16 which temporarily stops conveyor 15 ^{carrying} positioning the piece to be coded thereon while awaiting release of the piece downstream thereof which is being scanned and coded.

Monitor station 20 includes a monitor screen 30 which provides an enlarged image of the address 75 on the face of the card or envelope E when the latter is disposed in the scanning field of a television camera 33 having its picture signal output 34 connected to the video receiver containing the monitor screen 30. Thus the operator of the station may easily view the state and city destination printed or written as part of the address 75 of the card, permitting him to properly code the lower edge of the card.

The monitor station 20 includes a console 206 having,

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in addition to the monitor screen 30, a single pushbutton cycle control switch 29 and a panel 26 containing a plurality of pushbutton coding switches 26S. By properly depressing the banks of coding switches 26S, parallel destination codes are generated on the outputs 27 thereof which extend to a shift register 28 for converting the parallel codes to a series code which is held therein until an input 32' to the shift register is energized after which the series code is ^{applied} fed to activate a recording device 24 which records the series code along the lower border or edge of the piece E.

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Upon activating ^a cycle control switch 29, a control signal is generated on a plurality of circuits including a circuit extending to the control ^{for} of the motor-operated device 14 for releasing the next piece from the bin 11, the start control F of motor 16 for driving the piece held upon conveyor 15 to conveyor 19, the start control F of motor 25 for driving conveyor 19 to remove the previously coded piece therefrom onto continuously driven conveyor 35 and a delay relay 32 in the line 32' leading to the trigger input of the shift register 28. A delay in the operation of the shift register is ^{thus} so provided to permit the leading edge of the piece E to be coded to ^{to be driven past} pass the recording transducer 24. After recording is effected, the piece is transferred from conveyor 19 to conveyor 35 which ^{extends} leads to a plurality of branch conveyors, designated 40, 41, etc., onto one of which the piece is conveyed or ^{transferred} deflected by means to be described.

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Edge or border coding of each piece on the conveyor 19 may be effected in one of a number of manners depending upon the marking or recording system provided. In Fig. 1, an automatic, motor-operated applicator 21 for recording material has its output closely disposed to the predetermined path along which each piece is conveyed on conveyor 19 and is operated by

a signal generated by a time delay relay 31, which is activated when the cycle start control switch 29 is activated. In other words, at some time after the piece E has been started ^{its} movement towards conveyor 19 from conveyor 15, the applicator device 21 dispenses a recording material by spraying or rolling same along the lower edge or border of the mail piece as it passes said applicator. In one form of the invention, the recording material may comprise magnetic oxide which is roller or spray coated along said edge or border or is otherwise applied thereto as the piece is fed past the applicator on conveyor 19.

A photoelectric detector 22 detects the leading edge of the piece E and its control 23 generates a pulse output to the stop control S of motor 25 which predeterminately positions the piece in the scanning field of the video camera 33. The operator of the station 20 reads the address 75 on the face of the piece E and, either mentally or by reference to a chart, ^{generates} sets up the necessary address or selection code by properly ^{operating selected} depressing the switches 268 on the control panel 26. Thereafter, the cycle is repeated when the operator depresses start cycle control switch 29 after which the recording transducer 24, which may comprise a magnetic recording head, ^{is} engaged or rolled against the ~~roller~~ edge or border of the piece E containing the recording material provided by device 21. The motor 25 is operated to remove the piece E from conveyor 19 ^{to transfer it to} onto conveyor 35 until the photoelectric ^{detector} 22 detects the leading edge of the next card whereupon motor 25 is stopped by pulsing the stop input S thereof.

The piece E may be stored downstream of conveyor 19 in the event that it is a card to be edge coded or, if it is a mail piece it may be conveyed on conveyor 35 past a magnetic reproduction transducer 36, ^{which is} operative to ^{operably} engage the magnetic recording material ^{applied to} disposed along the lower edge or border thereof.

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and to reproduce the code provided as a recorded pulse train along ^{such} ~~said~~ lower portion of the piece. The output of reproduction transducer 36 is passed to an amplifier 37 which generates a series code on its output, which ^{output} extends to a logical switching circuit controller 38 which controls a servo ^{operating a gate} ~~39 operating a gate~~ deflection means 39' for properly ^{transferring} ~~gating~~ the piece to one of a plurality of branch conveyors 40, 41, etc. for properly routing the piece E along that path which is indicated by the code provided on its lower edge and reproduced by reproduction transducer 36.

In Fig. 1, notation PS refers to a power supply for electrically powering the switches, controls and motor device 30 associated with the monitor and coding switch controller 20C for generating the described control and code signals on the outputs thereof. It is assumed that suitable power supplies are provided on the proper sides of all switches, controls and motors illustrated in Fig. 1, such not having been illustrated therein for the purpose of simplifying the drawings.

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~~It is noted that the~~ recording material device 21 may be subject to a number of variations depending on the coding, recording and scanning apparatus used in the system. For example, device 21 may adhesively apply coded or uncoded tape, such as magnetic recording tape, along a selected band area such as near or parallel to the lower edge of member E. Printed or other optically scannable tapes or recording material may be applied by suitable roller, ^{applying} means comprising part of device 21 which may also contain recording means for the code operatively connected to the code generating means described herein. Device 21 may also comprise a printing wheel for magnetic material or ink for applying machine readable characters or codes along the piece E as it is driven therepast. Device 21 or the transducer 22

may also comprise a laser and means for pulse modulating its output with code signals for burning a code along or parallel to the lower edge of members E or containers fed therepast.

It is also noted that reading device 36 may be a photoelectric reading system such as employing a light reflected off an electro-optically readable code applied by one of the means defined herein.

While the monitor and coding station 20 is provided with manual coding and envelope transfer control means in the form of the switches 268 and 29, it may also be operative in an automatic mode whereby the routing codes are generated by electro-optically scanning the address lines 75 printed on the mail pieces and generating a code by operating suitable character recognition means. In this connection, the video camera 33, or a suitable auxiliary electro-optical scanner, may be provided to scan the face of the mail piece containing the alpha-numeric representation of the address destination on lines 75 thereof and to generate a video picture signal output on line 34, which is passed to suitable computing circuits including character recognition means defined by notation 43. A switch 42 in the output line 34 of the video camera 33 may switch the video picture signal from the monitor screen 30 to the computer 43 in the event that, for example, all mail pieces E are provided with easily recognized characters, such as ^{defined} typewritten or printed addresses, which are predeterminedately positioned along the face of the mail piece. Parallel outputs 44 of the computer 43 extend to the inputs to the shift register 28 for transferring a parallel destination code, as computed by the circuits of computer 43, or a single output may extend from 43 directly to the coding transducer 24. Another output 45 of the computer circuits 43 may extend directly to the output of switch 29 for effecting the described operational cycle. However, since the video camera or optical scanning device 33 operates at relatively high speed to scan the face of the mail piece, containing the address thereon, such scanning may be effected on-the-fly without the need to stop individual pieces in the scanning field of the camera, as described, and the apparatus ^{and} of the camera may be operated in a manner to present mail pieces one behind the other and in constant motion of the described conveyors.

The automatic scanning means for identifying the document, envelope or package and/or determining its destination so as to provide a coded electrical signal for controlling recording as described, may comprise a conventional electro-optical character reader, adapted to read all lines of the address or label 75 and, by logical ^{or} ~~other~~ ^{means}, determining the destination and/or other characteristics of the document for coding purposes. In a preferred form, means may be provided for the reader to read just the last line of characters and preferably the last portion 75Z thereof which may comprise the zip code. Suitable optical scanning means may be provided, such as an electron beam scanning means adapted to scan laterally from or near the bottom edge of the envelope upwardly until the last line of characters is identified and ^{is operable} to generate a pulse output upon ^{detecting such} ~~selecting said~~ last line to control ^{the} positioning of the line scanning means, to scan said last line only. If the envelope is fed lateral to its longitudinal edge 73 ^{such as} ~~with said edge leading same~~, by means ^{U.S. No. 3,309,669} ~~as provided in my patent~~, then the activation of any one of a plurality of photoelectric detectors, scanning the face of the envelope and disposed in a line parallel to edge 73, may generate a signal when the last line 75Z of characters ^{is scanned, such} ~~passes said cells and said control signal~~ may be employed to stop the driving of the envelope and initiate the ^{operation} ~~movement~~ of the scanning disc or beam to ^{scan said last line which may} ~~comprise the town and city or just the mail zip code per se.~~ ^{character defining} ^{maybe} ^{such} ^{definedly} ^{signals} ^{by} If ^{the} last line is ^{just} the zip code, the code output of the scanner may be a series of binary codes indicative of the zip code which may be recorded, as described, along the recording area of the envelope or may be electronically converted to a single binary series code indicative of the zip code number ^{applying same} ~~prior to being used~~ to modulate the recording transducer. A suitable time delay relay may be employed to initiate the motor

driving the envelope from the reader onto, for example, a conveyor of the type described such as edge travelling conveyor 35.

If an electron beam scanning means is ^{operable} provided to read the zip code 75Z, suitable logical switching circuitry may be provided to detect the last line or zip code portion of the address 75 and cause the read beam of the ~~cathode ray tube scanner or other scanning means~~ to read ^{such} just said last line or zip code or ^{control} operate a gate to pass the modulated analog signal output of the read beam thereof ^{generated when scan} derived in scanning ^{last of characters} said line or code to a suitable ~~memory computing means or means~~ for converting ^{such} said analog signal to ^a the suitable coded signal ^{which may be and control} form used to modulate the described magnetic or optical recording means. If the zip code comprises the last line of ^{Printed matter} characters ^{Resulting signals may be} it may be read per se and the ~~results~~ applied to the recording transducer. ^{Such zip code is but} If it ~~comprises just the last~~ part of the last ^{the address being read} line, beam scanning ^{end} from the ^{containing such code} right edge of the line until ^{is detected} a ^{end} gap appears between the zip code and edge of the ~~state address~~ portion of the last line, ^{which scanning} ^{is} will determine the longitudinal limits of the zip code number and may be used to generate signals ^{defining such} indicative of just said zip code number.

Thus, it is seen that the apparatus defined in FIG. 1 may be operated either by a ^{Person viewing} ~~human being scanning~~ individual mail pieces when ^{Such} ~~said~~ mail pieces contain a variety ^{or} of addresses in printed or handwritten form ^{and disposed at} of various configurations and locations or may be automatically ^{effected} ~~operated~~ if the mail pieces and their printed addresses are ~~relatively uniform and capable~~ ^{being} of electro-optical ^{scanned} ~~scanning~~. Switch 42 in the output line 34, ^{either} may be manually operated to define ^{operation} automatic or manual operation of the scanning and coding ~~station~~.

The automatic scanning system defined by scanner 33 and computing circuitry 43 may be operated in accordance with known address scanning and recognition equipment or that provided in my parent application ^{relating} ~~serial number~~ ^{select} 622,650 which provides a ~~reading disc~~ ^{disc} for reading a ~~predetermined~~ ^{selected} line of a document or ~~card~~ driven past the scanner or by moving the scanner past the document.

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Fig. 2 illustrates a ~~preferred form of~~ conveyor for edgewise conveying thin oblong members E, such as cards and envelopes, to be coded. The features shown in Fig. 2 may be applied to any or all of the conveyors 15, 19 and 35 of Fig. 1. The oblong card or mail piece E is disposed in the channel-like guideway defined by longitudinally aligned conveyor wheels 54 having outer surfaces which taper sharply inwardly as illustrated to provide ^{V-shaped} ~~wedge-like~~ wells for the cards or envelopes resting on the upper surfaces thereof. ^{aligned} The plurality of longitudinally ~~aligned~~ wheels 54 are rotationally supported in spaced-apart relationship by a channel-like member 50 the side walls 51 and 53 of which contain ball bearings B which rotationally support the shafts 54S of the wheels 54.

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The single concave, wedge shaped roller 54 of Fig. 2 may also be replaced or supplemented by a plurality of cylindrical rollers disposed with their peripheral surfaces properly angled to the horizontal with alternate rollers of ^{an} ~~a~~ line array of said rollers angled ~~oppositely~~ and power rotated to provide the same lower edge aligning, guiding and driving effect as the single rollers 54 illustrated in Fig. 2.

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Other conveying means may also be provided to preterminately align and guide the lower longitudinal edges of each envelope or card along a predetermined path for coding and reading same as described. For example, the horizontally angled surfaces defined by the inwardly tapering conical portions of the rollers 54 of Fig. 2 may be replaced by a pair of power driven flexible belts each angled ~~properly~~ upwardly and driven in the same direction at the same speed with their lower edges ^{disposed} close to each other or the lower edge of one ^{abuts} ~~abutting~~ the upper surface of the other, ^{so as} to provide a guideway for the lower edge ^{or} of each mailpiece. A single belt or pulley of resilient material, folded or having a W-shaped upper surface may also be utilized.

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In the embodiment of Fig. 2, it is noted that said wheel shaft 54

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extends outwardly through the bearings from the wall 51 and contains pulleys 58 on the ends thereof which are rotated by a chain or belt 58' driven by a pulley or sprocket on the shaft of motor 16 so that all wheels 54 rotate simultaneously to drive the piece E therealong.

^{Cantileverly supported}
~~Cantilevered~~ on the sidewalls 51 and 53 of the channel 50 and extending upwardly therefrom are a plurality of pairs of leaf spring members designated 55 and 55' each of which supports a pillow block ^{described} ~~designated~~ 56 and 56' which rotationally support respective wheels 57 and 57', the peripheries of which are spaced apart a degree greater than the thickness of the average piece E, although ^{possibly} ~~less~~ than the thickness of ~~what may~~ be the heaviest gauge or thickest mail piece. Thus, while some degree of lateral movement of the mail piece E may be effected between the rollers 57 and 57' ^{Such} ~~said~~ mail piece will be guided thereby and, if said wheels are power rotated by means such as that rotating the wheels 54, further means will be provided for powerdriving the member E along its ^{guided} ~~predetermined~~ path.

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Since the lower edge of all pieces E is determined by the path defined by the low point of the ^{radial} ~~groove~~ or recess ^{formed} in the wheels 54, various devices such as the described magnetic recording and reproduction transducers, recording material application means and edge detection means may be provided between adjacent wheels 54 as illustrated in Fig. 2 ^{where in a recording} ~~by the device~~ 59 which is supported by the bottom wall 52 of the channel 50 and is removably secured thereto by means of adjusting nuts ^{which retain same} 59' ~~holding member 59~~ in a hole extending vertically through the bottom wall 52. If the exterior wall of member 59 is threaded, ^{which is} ~~the end of the transducer 59T~~ secured thereby may be ^{and held} ~~vertically adjusted by proper adjustment~~ ^{adjusting} and ^{such} ~~tightening of the~~ adjustment nuts 59' against the wall 52 of the channel. The transducer head 59T illustrated in Fig. 2 is operative to scan or

signals along
1 record on the lower edge of the piece E although it may be so
shaped to scan or record along either or both the border areas
of E adjacent ~~said lower edge~~. Similarly, the transducer, photo-
electric detector or recording material application means may
5 be adjustably supported by either or both ~~of the side walls 51~~
and 53 of the channel 50 ~~for properly functioning as described~~.

Fig. 3 shows details of a modified form of feeding
bin 60 ^{operable} for individually feeding mail pieces or cards to a con-
veyor ^{extending} leading to a monitor and coding station as described.

10 Whereas in Fig. 1 the feeding bin 11 is operative to stack
the mail pieces or cards E so that they may be fed ^{from stacked already} in a ~~vertical~~
~~Such~~ attitude therefrom, the bin apparatus 60 of Fig. 3 may be oper-
ated ^{contain} with the cards disposed in ~~either a vertical or horizontal~~
stack or at an angle to the horizontal for coding with the
15 cards ^{their sides} vertically disposed as in Fig. 1 or lying on ~~its side~~.

The feeding means 60 of Fig. 3 includes a bin 61, the side
walls of which are preferably made of tubed metal sheet contain-
ing a plurality of tube formations 62, each with a passageway
63 interconnected with the passageways of the other tube forma-
tions ^{for} or feeding pressurized air from an inlet 67 through a
plurality of holes 64 which are angularly drilled in the walls
20 of bin 61 so as to direct a plurality of air streams against the
^{when gas pressurizing} uppermost piece of ^a the stack of ^{mail} pieces to force said stack
against the lower or far end wall 66 of the bin so that the
lowermost ~~or endmost~~ piece E' is directed against a controlled
belt conveyor 68 driven by motor 14. Thus, whenever motor 14
40 is energized for a predetermined period of time, piece E' will
be carried thereby between the power operated conveyor belts
69 and 70 which ^a comprise conveyor 15' corresponding to the
first output conveyor 15 of Fig. 1. Notation 71 refers to
30 a deflection plate for aligning and guiding one edge of each
mail piece fed to the conveyor 15. Each piece E' may be forced
by gravity or ^{by means of} wheels (not shown) ~~rotated thereon, against, the~~

plate 71 as it is driven onto 15' to align ^{the conveyor} all edges ^{the} there-
against ^{to permit to be effected as described} for coding ^{of all pieces} purposes. From conveyor 15' the
pieces are fed to ^{the} conveyor 19' corresponding
to conveyor 19 of Fig. 1 and comprising a pair of power ^{driven} operated
endless belts 72 and 72' between which the aligned piece E is
driven. Disposed adjacent the edges of belts 72 and 72' are
devices 21', 22' and 24' corresponding in function to the recording
material applicator 21, the photoelectric detector 22 and the
recording transducer 24 of Fig. 1, each of which is so mounted
to align its output with the edge or border of the card driven
therepast as the conveyor 19' operates. The conveyors 68, 15'
and 19' are intermittently and sequentially operated as described
in the description on the apparatus of Fig. 1.

In Fig. 3, notation 65 refers to holes provided in ^{opposite} the sidewalls of the bin 61 for laterally exhausting air injected downwardly through ^{bron} said bin against the stack of mail pieces or cards through the holes 64.

Figs. 4 and 5 illustrate mail piece or card structures employing different types of recordings along the edge or lower border portions ^{Hereof} of the pieces. In Fig. 4, the piece E is illustrated as an envelope or card having multiple address lines 75 containing written or printed name and destination characters and return address lines 75' disposed near the upper ^{left hand} ~~left hand~~ corner thereof. Disposed adjacent to the lower edge 73 of the piece E along the margin or border portion 74 thereof, is a ~~strip~~ ^{Healed}, tape or coating of magnetic recording material which may be applied ^{Healed} when the card or envelope is first fabricated, when it is addressed or by the means provided in Fig. 1 which may comprise a spray nozzle, roller coating wheel or applicator for a short length of magnetic tape; the magnetic recording material being generally defined by the notation 76 and illustrated as extending from the leading edge 73' of the piece E a sufficient distance along the lower marginal border 74 to permit the longest serial code to be recorded thereon.

elongated record

In Fig. 5 is shown an ~~oblong thin~~ member 75, such as an envelope or card containing address lines 75 of characters on one face thereof and a code 77 in the form of a plurality of spaced-apart, optically scannable marks 78 of predetermined ^{height} length and separated by non-marked spaces 79 which, when scanned, also define a portion of ~~said~~ ^{the printed} code. The marks 78, ^{printed} along the border portion 74 of the piece E" of Fig. 5, may be provided along ~~said~~ ^{the} lower margin and/or across the lower edge 73 thereof by one or more selective recording means including a selectively operable array of rotary mark printing devices, such as selectively projectable and retractable printing cuts disposed at the ends of the spokes of a wheel, the periphery of which rides against the edge 73 or border portion 74 of the member to be coated. The marks 78 may also be applied in the form of a code by the selective pulsing of a solenoid which projects and ~~retracts~~ ^{the record men} a printing cut or wheel against, and away from ~~said~~ ^{such} lower edge 73 ^{or border 73} or margin or by the selectively ~~operation~~ ^{disposed inlet} of a valve in the line of a small spray nozzle operative to spray apply printing ink or magnetic recording material to selected areas of the members E" such as the areas defined by marks 78. The recording transducer may also ~~take on other forms and may~~ include (c) a variable mask which is ~~set up~~ ^{operated} by bi-stable solenoids connected directly to the outputs 27 of the pushbutton panel 26 which mask may receive mark printing material from a spray head or roller ^{coating} ~~coating~~ means, ^{applied} ~~rolled~~ thereagainst to provide the necessary coded array or marks; (d) ^a modulated intense ~~beam~~ ^{beam generating} radiation means such as an electron gun or laser generating an intense beam, ~~may also be employed to either~~ burn ^{Select} ~~selected~~ portions of the border or margin 74 of the envelope or ^{Select} ~~selected~~ portions of a recording material such as 76, ^{so} ~~disposed~~ ^{therealong} to provide the necessary scannable code recording. The latter described beam recording means may be controlled, for

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Further details of the code applying wheel 88 of Fig. 6 are illustrated in Fig. 7 ~~which is a side view thereof with parts broken away and sectioned for clarity.~~ The printing wheel 88 comprises a disc-shaped hollow housing have upper and lower disc shaped walls 96 and 97 separated by a spacer ring 98 having a plurality of holes 98H extending radially therethrough. The printing devices 89 comprise a plurality of bi-stable solenoids 90 which are mounted on the bottom plate 97 inwardly of the ring 98 and have their shafts 91 extending radially to holes 98H. Secured to each shaft 91 of each solenoid 90 is a retainer 92 for a printing ^{cut} material 93, which printing material may be retracted so that its outermost surface is below the peripheral surface 88' of the wheel 88 when the solenoid 90 is retracted in one of its two bi-stable states. When the solenoid is pulsed or switched to its other bi-stable state, the printing ^{cut} material 93 protrudes outwardly from the peripheral surface 88' of the wheel 88 and provides means for applying a code mark to a surface against which the peripheral surface 88' of the wheel is rolled. Each of the solenoids 90 has an input wire pair 94 extending ^{radially inwardly along the interior of} ~~towards the axis of rotation of the wheel 88~~ and through a hollow shaft 95 on which the wheel is mounted, said shaft extending to a drive means such as a rotary solenoid or motor ^{which power rotates such} ~~operative to roll said wheel~~ against a surface, such as any of the band areas 76, 78 or 86 of an envelope, card or container ^{such as shown} ~~as illustrated in Figs. 4, 5 and 6.~~ The wires 94 may extend to an array of commutator and brush elements located on the shaft 95 or directly to respective code signal generating output means such as the outputs 27 of the binary code generating pushbutton switches 26S of the bank 26 illustrated in Fig. 1. The solenoid energizing lines 94 may ^{be connected to} ~~also connect directly~~ from a computer ^{or} ~~such as~~ the circuits of the hereinabove described means for automatically reading the alphanumeric address

75 on the envelope or card or other means identifying the article being coded. If the rotary solenoid is ~~provided and~~ coupled to shaft 95 so as to rotate the wheel 88, it may be activated, for example, by the signal generated on the output of delay relay 31 or a means such as the photoelectric scanner 22 which is operative for detecting the leading edge of the card, assuming that the conveyor along which the card is driven is operated thereafter for a sufficient time interval to permit the wheel 88 to effect a cycle of ^{rotation} ~~operation~~ against the member being coded. In an alternate form of the invention, the wheel 88 may be translated and rotated relative to the envelope, card or container while the latter is held stationary during a coding cycle.

The printing ^{cut} material 93 located at the end of the solenoid shaft may comprise a self-inking printing cut or other suitable material which either contains its own ink supply or is fed a supply of ink from a source located within the retainer 92, shaft 91 or the housing of the solenoid 90. A suitable material which contains sufficient ink to provide thousands of printed impressions is a micro-porous plastic containing ink or magnetic recording material in the cells thereof. U. S. Patent ^{No.} 2,777,824 describes a flexible plastic material ^{which} may be formulated to encapsulate a variety of liquids such as inks which may be dispensed upon compression of the material against the surface and such material may be utilized for the printing material 93 of Fig. 7.

It is noted that any suitable fast-drying printing ink or magnetic recording ink or magnetic recording ink may be dispensed from the periphery of the wheel 88 along the edge or border area of a card, mail piece, or container as described herein and illustrated in Figs. 4 to 6. The solenoids 90 may also be of the mono-stable type whereby electrical

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energy applied to selected of ^{such} ~~said~~ solenoids, will be operative to project the printing devices of each solenoid outwardly from the peripheral surface 88' of the wheel a suitable degree to permit spot marks to be ^{Printed on} ~~applied to~~ a flat mail piece or container in a coded array as described, depending on which of those solenoids are energized.

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The arrangement illustrated in Fig. 7 may also be operative to magnetically record a code on a strip of magnetic recording material such as 76 of Fig. 4 by replacing the printing material 93 with a ~~respective permanent or electro-~~ magnet which, when the shaft 91 of the solenoid is projected, ^{moves such} ~~projects the~~ magnet so that it will orient or disorient the magnetic domains of the magnetic recording material as the peripheral surface 88' of the wheel is rolled thereagainst or ^{so} ~~will not affect same~~ ^{such recording material} when retracted into the openings 98H.

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Further improvements to the described and illustrated apparatus may include the following. The free-wheeling wheels 57 and 57' of Fig. 2 may be replaced by a plurality of opposed jets of air operative to support the mail piece E in a substantially vertical attitude as it is driven along the wheels 54 or to drive or assist in the driving of said mail piece therealong.

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The wheels 57 and 57' of Fig. 2 may also be replaced by a plurality of endless, power-operated belts which are mounted on pivotted and spring-loaded arms equivalent to the cantilevered spring members 55 and 55' of Fig. 2 for driving the mail piece E therebetween.

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In Fig. 3 if the mail pieces E are fed vertically in horizontal attitudes in the bin 61 as illustrated in Fig. 3, they may be upended to attain the vertical position illustrated in Fig. 2 after they are fed onto the conveyor 68 by suitably designing conveyor 15' to receive ~~the~~ single mail pieces from

68, and eventually guide same to a vertical attitude. This may be effected by providing suitable pulleys and guides for the belts 69 and 70 to direct ^{such} ~~said~~ belts from a substantially horizontal attitude at the end of the conveyor which received pieces from conveyor 68 to a substantially vertical attitude at or near the end thereof so that the envelopes or cards may be fed ~~therefrom~~ vertically along conveyor 19 to preposition their lower edges and permit coding and reading as described. Accordingly, conveyor 15' may be used to upend and feed envelopes and cards to an aligned array of powered conveying wheels such as 54, either with the lower edge of each piece aligned with the bottom of the wheel indentation or smallest diameter or at different heights thereabove so that gravity may be utilized to cause the pieces to drop into the center of the receiving wheels to align the lower edges of said mailpieces. Depending on the maximum thickness of pieces to be conveyed, the slopes of the sidewalls of the depression in the wheels 54 may be greater or less than that illustrated. In fact, by providing wheels 54 with very steep wall portions and sufficient difference between maximum and minimum diameters, the support means for the upper walls of the envelopes or cards may be eliminated whereby each mailpiece is supported in a vertical or near vertical attitude, as it is driven or conveyed, by the wheels per se.

Stationery intense radiation beam means such as a modulated light beam generated by a laser, an electron beam or other suitable beam generated by means ²⁵ fixedly mounted with respect to the described conveyors may be used for recording and/or reading codes disposed along or parallel to the lower edge of each mailpiece or carton as the piece is driven therepast. Writing or recording codes or characters along said recording area may be effected by modulating the beam intensity to (a) burn and discolor the material such as paper comprising the piece, (b) discoloring or sensitizing a material applied as a spray or roller coating thereon, (c) discoloring or sensitizing a recording material applied as a tape

which has been disposed along a predetermined band area of the piece as described, (d) demagnetizing by heat selected areas of a domain oriented magnetic recording material applied as a tape or coating rolled or sprayed onto the selected area of the piece, (e) burning one or more holes completely through the card, envelope or ^{article} ~~article~~ fed past the beam generating means to permit light to pass therethru for optical reading purposes or to permit switch contact means or switch arm moving means to become activated as the piece passes the reading station, (f) burning selected areas of an opaque coating material such as a ^{polymer} ~~polymer~~ disposed as a film over a reflecting material or a metal tape or film applied to the recording area of the piece to permit electro-optical or electrical reading means to read said uncovered areas by fixed transducers or scanners operative to scan said piece as it is driven therepast, (g) burning selected areas from an opaque coating in the form of a code or character area array ^{and} uncovering a reflex reflecting material disposed beneath ^{such} ~~said~~ opaque coating to permit electro-optical reading by photoelectric cell means receiving light from a light beam directed against said uncovered reflex reflecting material, (h) burning away ~~of~~ selected ~~areas or the desensitizing of~~ selected areas of luminescent material which is roller printed, spray applied or otherwise provided on the face of the piece, such as on one or more postage stamps. With respect to the latter described means for recording destination codes, it is noted that postage stamps or labels may be affixed to the surface of the piece which may have luminescent or sensitized material coating the entire area thereof as a printing ink or applied along a border thereof and operative to be burned off or desensitized as a series or parallel bit code along spot areas thereof by the described intense recording radiation beam.

5 There is shown in Fig. 8 one form of circuitry for controlling the recording of a code defined by ~~beam~~ pulses of intense radiant energy generated by a laser directed at a moving object, such as a mail piece, product container or work in process disposed on a conveyor. In Fig. 8, the object is illustrated as a ^{rectangularly} ~~rectangular~~ shaped container 80, which is adapted to move on a powered belt conveyor 87 past a laser 100 which is supported within a housing 101 disposed immediately adjacent the conveyor 87 on a mount 102 and directed to permit the pulsed beam B thereof to intersect all containers or work pieces at a predetermined distance above the conveyor so that if the work pieces are all properly aligned on the conveyor, each will have a code burned or otherwise provided in its surface ~~at a~~ predetermined distance from the edge or surface thereof disposed against the conveyor.

15 The laser 100 is shown as a solid-medium laser containing a ruby rod 103 surrounded by a flash tube 104 which is pulsed by energy fed thereto so as to pump the laser and cause it to generate a pulsed output. Other forms of lasers may also be provided, such as a so called CO2 laser, which may be modulated or pulsed in its operation by ^B means similar to that illustrated in Fig. 8 or by other simple means operable in response to a series ~~chain~~ of control signals defining the code information to be recorded on the container or object ^{on} ~~moving along the~~ conveyor. In other words, the circuitry illustrated in Fig. 8 is only suggestive of one form of the invention wherein the heat generated by each light pulse of the laser may be operative to discolor or bore cavities in the surface of the container or work, or to discolor, cavitate or otherwise effect a pulse code recording therein.

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5 The control circuitry 105 includes a variable high voltage
power supply 106, such as a half-wave power supply fed by a
110-volt, 60-cycle alternating current which converts said
current to a pulsating direct current of high voltage applied
to charge a bank 107 of capacitors which store electrical energy
through a resistor 108. As illustrated, the flash tube 103 is
connected across the terminals of the capacitor bank 107 and is
applied to fire the laser for generating a pulse of intense
light energy when a trigger switch 110 is closed. The trigger
switch 110 is connectable in series with a ~~trigger~~ transformer
111 and a ~~trigger~~ power supply 109. When switch 110 is in its
closed or energized position, voltage from power supply 109
connects the ~~trigger~~ capacitor 112 across the primary of the
~~trigger~~ transformer 111 which develops a high voltage pulse
across the secondary of the transformer which is fed to the
xenon flash tube 103 causing the gas thereof to become con-
ductive and firing the flash tube which irradiates the laser rod
with a brilliant flash of visible light causing the laser to
emit a high energy pulse of light which is directed at the
article or object 80 moving along the conveyor 87.

25 Depending upon the parameters of the firing circuitry and
the frequency at which the switch 110 is closed, a series of
pulses may be generated on the output of the laser 100 and
directed at the object 80 moving along the conveyor so as to
record a series pulse code on or within the surface stratum
thereof by burning, discoloring or sensitizing the material
thereof along a band area a predetermined distance above conveyor 87.

30 The trigger switch 110 is shown as being operated by means
of a monostable solenoid 113, which may be pulsed to close the
switch momentarily each time it receives a control signal. The

control signals fed to operate the solenoid 113 may be generated, for example, by the means illustrated in Fig. 1 (e.g. by the signals generated on the output of parallel-to-series convertor or shift register 28 ⁱⁿ set up ^{switching} by a manual switch bank, such as a keyboard or other suitable means, such as the signals generated in selectively reading recordings from a memory.

The means of Fig. 8, which is operable to cause the shift register 28 to generate the series code signal held therein, comprises a ^{photoelectric} photo-electric cell 120 scanning across conveyor 87 and receiving light from a light source 121 disposed at the opposite side of the conveyor. When the object or article 80 travelling on the conveyor 87 intercepts and blocks light from light source 121, the photo-electric controller 122, which is connected to the photo-electric cell 120, generates an output signal which is passed through a delay relay 123 which is connected to the trigger or readout control input 124 of the code generating device 28. The output of code generator 28 is connected an amplifier 125 which generates pulses of sufficient intensity to energize solenoid 113 and momentarily closes switch 110 to pulse the laser 100. As stated, means other than the circuitry illustrated in Fig. 8 may be utilized for pulse modulating a laser which is operative to scan the surface of a container, unit of work-in-process or other object moving along a conveyor for coding same as described.

While the code to be recorded on the object is initially generated in Fig. 4 by means of a keyboard 26 as described, it may also be generated from ^{Signal derived from} recordings in a memory such as a core memory, magnetic drum, relay storage banks or other form of memory as selectively reproduced therefrom in response to ^{control} signals generated in detecting and identifying an object ^{comprising one} of a plurality of different objects passing the coding station. The keyboard may also be wired to permit it to effect the selection of code recordings from a memory by manually closing a particular switch or key closure.

For example, the rotating disc electro-optical reading -
and character identification means provided in my patents (3,309,689^{U.S. Pat. No. 5}
and 3,555,246^{NS}) may be modified to read characters on an article
such as a mailpiece^B to generate digital signals representative of^{NS}
the characters read, such as the town and state or zip code, present^{and to}
said digital signals to a computer having comparator means and to^{NS}
thereby effect the generation of a code such as a binary digital
pulse code, which is applicable, for example, to gate a laser on and
off^{NS} a number of times, as in Fig. 8^{NS} to effect the recording by the
beam thereof of a series code or codes along a band area of the
object as the object is conveyed past the laser.

Various other means may also be employed including
electron beam scanning means such as a flying spot scanner^{by means of} for
scanning the face of an envelope or other container of mail having
an address thereon and generating code signals^{representative} of^{representative}
the destination or address printed on the face thereof. These
signals may be applied to a computer containing a memory of all
destinations in code form and a comparator means for comparing
the mailpiece generated signals with the codes of the computer
memory. The comparator is operable to effect the generation of
a code which is then applied to operate the laser to effect the
recording of marks, cavities or holes along a band area of the
side wall or along an edge of the mailpiece, as it is conveyed
past the laser as described. The need to^{record} apply the signals gener-
ated in scanning the alpha-numeric characters^{and} representative of^{representative}
the address on the mailpieceⁱⁿ to a memory may be eliminated if
the scanner is operable to scan so called zip codes printed as
numerical characters on the mailpieces. The digitized results
^{are} (e.g. binary code signals)^{defining} the zip code^{and} may be
applied^{to} directly to modulate or gate the laser beam on and off^{NS}
as the object is conveyed therepast^{NS} to provide the described code
along a band of the side wall of the object.

By applying an easily readable code, ^{in the form of} such as a series of properly spaced marks, holes or other form of recording, as above described, to a predetermined band area of a mailpiece, the first time the mailpiece is automatically scanned, ^{may be} a routing system ^{is} provided wherein equipment required for ~~subsequent~~ scanning and routing of the mailpieces is greatly simplified. It is noted that the described means for digitizing an address on an envelope or mailpiece of any shape ^{which define} and ^{representing} generating a code ^{may define} identifying the address ~~is~~ a relatively complex computing operation requiring complex and costly equipment ^{both} not only to effect the digitizing and comparison ^{and} but also to properly position the reading means with respect to the printed address or zip code which may vary in location from mailpiece to mailpiece. Accordingly, if the proposed single scanning, identifying and coding means is applied to provide a code to the mailpiece as described, subsequently used scanning equipment may be substantially simplified as it may only comprise simple photoelectric detectors or magnetic transducers ^{reading} for the simple codes applied to predetermined areas of each mailpiece ^{as} ~~hereinbefore~~ described.

Modified forms of the apparatus herein described may be utilized to identify and code or merely identify objects on a moving conveyor, such as articles of manufacture, work-in-process, containers of products, material or work-in-process, etc. Fig. 9 shows an apparatus for identifying and coding articles ~~moving~~ on a conveyor past a scanning station containing one or more scanning devices, such as flying spot scanners 130 and 150 or modified TV cameras. Identification is effected by ^{Suitably} ~~suitable~~ beam scanning one or more dimensions of the object as it passes or is stopped at the scanning station and generating code signals which are repre-

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representative of the dimension or dimensions scanned, then comparing such signals with signals recorded in a memory representative of all the objects expected to pass the scanning station and, when a match of the signals ^{generated} is effected, generating a code which is representative of the identification of the object. The code, so generated by the identifying means, may be recorded in a memory for auditing or inventory ^{Purposes}, may be applied to operate routing ^{apparatus} controls disposed along the path of travel of the ^{objects. Such codes} object and may be applied to operate a code recording apparatus such as the ^{recorder} described magnetic recording means, ^{printer} printing means or laser recording means.

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The flying spot scanner 130 of Fig. 9 is operable to scan one or more band areas BA of the side wall of the objects 80' as they ^{pass through} enter the scanning field, ^{which} the band areas ^{extend} being parallel to the upper surface of the conveyor 87 on which the object is traveling and spaced apart ^{are} such as to provide ^{signals indicative} a representative indication of the shapes of ~~all~~ objects passing the scanning station, ~~at least with respect to the side views thereof. In other words,~~ ^{Automatic} the automatic deflection control circuits for the beam of the scanner 130 are ^{operable} designed to cause the beam thereof to scan ^{the} back surface of each object ^{each along paths} and forth a number of times at different predetermined heights above the conveyor 87. The respective video signals generated during each scanning are digitized and the binary digital codes ^{generated are} thereof representative of the object's dimensions scanned, and are presented to comparator circuits containing signals presented thereto from a memory. When a match occurs in the comparator circuits, signals are generated which are representative of the object identified. These signals may be applied to code, route or otherwise affect the object or may be recorded.

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In the arrangement illustrated in Fig. 9, ^a the flying spot scanner 130 is triggered to initiate scanning an object by a signal generated by ^a photoelectric detection means when a light beam from

40 a light source 121' ^{120'} and directed at a photoelectric cell ^{positioned} across the conveyor is interrupted by the object to be scanned. ^A The photoelectric control 122' then generates an output signal which is passed to the trigger input 131 of the flying spot scanner 130 and initiates a scanning cycle. The video signal output of scanner 130 is ^{passed on} a line 132 ^{through} to a rotary stepping switch 136, or its electronic equivalent, to a series of digitizing and comparator circuits by ^{causing such} properly operating switch 136 to step after the beam has completed a horizontal scanning sweep of sufficient distance to ^{permit it to completely scan} have totally scanned the width or length of the ^{maximum} longest dimension ^{all objects} expected of every object presented to the scanning station along the particular level scanned. The switch 136 is stepped to pass video signals ^{respective} therethrough to different comparator circuits so that ^{signals} a sample representation of the side view shape of the object may be obtained. The horizontal scanning ^{sweeps along article band areas} lines or bands BA may be provided at every half inch, inch or ^{select distances} other distances apart, such that ^{scanning} signals may be generated for all objects which may be automatically analyzed to permit the discrimination of all objects ~~from the others~~ in the system and the automatic identification thereof. ^{The} ~~Thus~~ the switch 136 ^{may be} is stepped by a solenoid operated by vertical deflection signals or timing signals generated by the scanner after completing a horizontal scanning sweep ^{The} and the complete video signal generated by ^{such} said scanning sweep ^{so this} has been passed through the switch 136 to ^{selects of a plurality of} a particular comparator circuit. ^{Circuits 143} Notation 134 refers to a time delay relay in the output ^{of the television camera} 133 for properly delaying the operation of the solenoid ^{for operating} switching switch 136 if the vertical sync deflection control signal employed to ^{control} deflect the beam ^{to} for ^{effect} one horizontal sweep is ^{also applied} utilized to ^{operate} switch the rotary switch to pass the video signal generated during the next sweep.

Each of the outputs 137 of the rotary distribution switch 136 expands to a respective chain of circuits for digitizing and ~~comparing~~ matching the code signals representative of the length of the object scanned with ^{code} recordings provided on a magnetic drum 151 ^{which are representative} containing code recordings of the dimensions of ~~all~~ objects presented to the conveyor 37 for identification. The recordings are in binary digital form and ^{are} arranged on the drum 151 such that all those recordings which are representative of the dimensions of a particular object to be identified will be reproduced simultaneously by ^{banks of} magnetic pick-up heads 152 which ^{are connected to} feed respective comparators of signals generated by digitizing and ~~generating~~ ~~binary code signals of~~ each of the video signals which are representative of the ~~actual~~ lengths of those portions of the object scanned. Each video signal generated during ~~a single~~ horizontal scanning is passed through a particular output of switch 136 to ^{respective} logic circuitry 138 ^{of the type described U.S. No.} as provided in my ^{patent} 3,081,379 for ~~oper-~~ ^{processing such} ~~ating on~~ the video signals and generating ^{edge indicating} respective pulses ^{at} ~~those points~~ in scanning ~~when the beam crosses the leading edge~~ of the object and ~~leaves the end of the object.~~ ^{Such} the pulses are applied ^{to} respectively ^{to} start and stop a digital clock or gate the output of an analog-to-digital converter provided as part of a logic circuit 139 which generates on a plurality of outputs ^{each of} 140 ~~a binary digital code in parallel~~ which codes is representative of the length of that dimension or band area of the object scanned ^{by} ^{as it} during the particular sweep of the beam ^{which} generates the video signal so digitized. The parallel code on lines 140 is passed to a holding relay bank 141 and held in relay storage therein to activate parallel outputs 142 thereof which extend to a code matching relay 143. The code matching relay is designed in accordance with the teachings of my application ser. no. 225,173 and ^{U.S. No.} ^{patent} 3,081,379 and generates a control signal on its output 145.

when ^a the code present on its inputs 142 matches the code present on its inputs 144 ^{generated by} from the magnetic drum pick-ups.

When the outputs 145 of the code matching relays 143 are all simultaneously activated, a condition which indicates that all of the dimensions derived by scanning all elements of the side view of the object match or correspond to the signals recorded on the drum which represent a similarly shaped object, a signal is generated, indicating such condition, by a logical AND circuit 146 having its plural inputs connected to said code matching relay outputs. Drum recording tracks provided along an end-recording area 151' of the drum 151 contain code signals representative of the objects to be identified. These signals are so located that they may be respectively reproduced by a bank of pick-up heads 147 when their respective ~~object~~ ^{are} dimension representing codes are present at and, being reproduced by the heads 152 which are connected to the code matching relays. ^{Normally} ~~A normally~~ ^{switches} ~~upon~~ switch 148 in the outputs of heads 147 prevents the passage of the codes generated by ^{such} ~~said~~ heads to a parallel-to-series converter 149. Switch 148 is closed by ^{an} the signal generated by AND circuit 146 ^{only} when all code matching relays are activated so that ^{only} the code representative of the identified object is passed to converter 149, the output of which extends to the control circuitry 105' for the ^a recording laser 100' which is located, and operative in response to said code, ^{an} to effect the recording of the identifying or routing code on the object as described. The code generated on the output of parallel-to-series converter 149 or ^{multi-pole} switch 148 may also be applied to a recorder or computer for recording purposes or for generating further signals for controlling automatic operations on or with respect to the object identified.

If objects carried through the system are ^{so shaped} ~~of such shapes~~ that they may not easily be identified by scanning one side thereof as described above, they may be automatically scanned from one or more

5 other directions one or more times as described, ~~for example, from~~
overhead by means of a second TV camera or flying spot scanner
such as 150, having its ^{television signal} output connected to circuitry, such as
that provided for camera or scanner 130. The single drum 151 may
contain signal recordings of dimensions scanned from ^{such} said other
directions and may rotate at ^{a sufficiently} sufficient high constant speed,
say 10 to 100 times per second, to permit the rapid identifica-
tion of all objects even if they are moving quite rapidly on the
conveyor past the scanning station.

10 Individual photoelectric scanning cells may also be
utilized to effect automatic scanning, one for each level to
be scanned, and each having its output connected to suitable
digitizing and code matching circuitry of the type described,
wherein movement of the objects along the conveyor is constant
and provides means for generating variations in the scanning
signals when the leading and trailing edges of the objects ^{scanned} ~~scanned~~
pass the photoelectric cells. ~~Said variations or rating of the pho-~~
photoelectric ^{detection} cell signals may be detected and applied to gener-
ate binary code signals indicative of the lengths of the various
^{portions} ~~bands~~ of the objects scanned and applied to effect code matching
as described, for identifying ^{such objects} the object. The code or codes gen-
erated by heads 147 may ^{define} also contain commands for ^{controlling} performing pre-
programmed operations on the object or work so identified when
^{such} said codes are either fed directly to a machine or machines to
be operated thereby or after they are recorded on the object and
^{controlled} and the recordings are later read by a transducer located at one or more ^{machines} ~~machines~~.

25 A system of the type defined in Fig. 9 may be modified
to permit the automatic identification and/or coding of two or
more objects of the same shape, ~~but~~ which differ in certain inter-
nal characteristics, weight or contents. For example, a weight sens-
ing transducer may be disposed at the scanning station and opera-
tive to generate a signal which is indicative of the weight or
contents of the object being scanned. ^{Such} Said signal may be digitiz-

and applied to a comparator along with the signals generated by scanning one or more wall of the object as described. When a match of all signals occurs, the object is identified and the resulting generated code signal, generated as described, applied to code, route, or perform computations relative to the object.

In yet another form of the system of Fig. 9, product containers of similar shape may be differentiated as to contents and identified by automatically scanning and digitizing the results of scanning a label or printed illustration provided on a wall of the object. Selective area scanning means as provided in my U.S. Patent No. 3,081,379 and parent application ser. no. 254,710 may be utilized to scan and generate digital signals of indicia on a selected portion of a wall of the object wherein said signals are applied as in Fig. 9, to suitable comparator or code matching means and compared with signals reproduced from a memory per se or in combination with signals generated in scanning certain dimensions of the object for providing identification by matching all the codes generated with ^{code signals reproduced from} reproductions of recordings derived in scanning similarly shaped and illustrated or labeled objects.

~~The~~ ^{in providing the above embodiment of the invention, the} same scanner or TV camera used to scan the dimensions of the wall of the object containing the indicia or label may also be programmed ^{and} operated to scan said labels or indicia to generate signals therefrom which may be compared, as described, with recorded ^{reproduced from recordings} signals. It is also noted that a single flying spot scanner or TV camera may be employed to properly scan an object from a plurality of directions by the provision of suitable mirrors and other optical components disposed at the side of and above the conveyor at the scanning station.

In the hereinbefore described embodiments employing beam scanning of objects on a conveyor, it is assumed that suitable means are provided upstream of the scanning station for properly aligning all objects on the conveyor so that they may be properly scanned.